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## 1 Routine/Function Prologues

### 1.0.1 iniTimeConst.F90 (Source File: iniTimeConst.F90)

Initialize time invariant clm variables

Method:

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*USES:*

```

use precision
use infnan
use clm_varder
use clm_varpar , only : nlevsoi, nlevlak
use clm_varmap , only : begpatch, endpatch, patchvec, numpatch
use clm_varcon , only : istsoil, istice, istdlak, istslak, istwet, spval
use pft_varcon , only : ncorn, nwheat, roota_par, rootb_par, &
                      z0mr, displar, dleaf, rhol, rhos, taul, taus, xl, &
                      qe25, vcmx25, mp, c3psn
use clm_varsur , only : zlak, dzlak, zsoi, dzsoi, zisoi

use clm_varctl , only : nsrest
use time_manager , only : get_step_size
use shr_const_mod, only : SHR_CONST_PI
use spmdMod      , only : masterproc

#if ( defined OPENDAP )
  use opendap_module
#else
  use grid_module      ! LIS Grid variables
#endif
  use lisdrv_module

```

*CONTENTS:*

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! -----
! Initialize local variables for error checking
! -----

sand(:, :) = inf
clay(:, :) = inf

! -----
! itypveg, isoicol, itypwat, sand, and clay from 2-d surface type
! LIS modification: Read in soil files and equate lat,lon
! LIS grid arrays with clm grid
! Reynolds soil parameterization scheme
! Read in soil data maps to gridded arrays
! -----

```

```

#if ( defined OPENDAP )
    print*, 'MSG: iniTimeConst -- Retrieving SOIL file ',
        trim(lis%p%safile), ',(,iam,)'
    call system("opendap_scripts/getsand.pl //ciam// " //
        trim(lis%p%safile)//" //"
        cparm_slat//" //cparm_nlat//" //
        cparm_wlon//" //cparm_elon)
    print*, 'MSG: iniTimeConst -- Retrieving CLAY file ',
        trim(lis%p%clfile), ',(,iam,)'
    call system("opendap_scripts/getclay.pl //ciam// " //
        trim(lis%p%clfile)//" //"
        cparm_slat//" //cparm_nlat//" //
        cparm_wlon//" //cparm_elon)
    print*, 'MSG: iniTimeConst -- Retrieving COLOR file ',
        trim(lis%p%iscfile), ',(,iam,)'
    call system("opendap_scripts/getcolor.pl //ciam// " //
        trim(lis%p%iscfile)//" //"
        cparm_slat//" //cparm_nlat//" //
        cparm_wlon//" //cparm_elon)

#endif
    print*, 'MSG: iniTimeConst -- Reading soil, clay and color files'
    print*, 'MSG: iniTimeConst -- Opening soil file ',lis%p%safile
    open(11, file=lis%p%safile, form='unformatted', status='old')
    print*, 'MSG: iniTimeConst -- Opening clay file ',lis%p%clfile
    open(12, file=lis%p%clfile, form='unformatted', status='old')
    print*, 'MSG: iniTimeConst -- Opening color file ',lis%p%iscfile
    open(13, file=lis%p%iscfile, form='unformatted', status='old')
    read(11) sand1
    read(12) clay1
    read(13) color
    close(11)
    close(12)
    close(13)
    print*, 'MSG: iniTimeConst -- Read soil, clay and color files'
    do k = 1,numpatch
        if (tile(k)%fgrd > 0.0) then      !valid subgrid patch
            clm(k)%kpatch = k
            clm(k)%itypveg = tile(k)%vegt
            clm(k)%isoicol = int(color(tile(k)%col,tile(k)%row-tnroffset))
            clm(k)%isoicol = color(tile(k)%col,tile(k)%row)
            if (tile(k)%vegt == npatch_urban) then !urban, from pcturb
                clm(k)%itypwat = istsoil
                print*, 'ERR: iniTimeConst -- not supposed to be in urban block'
            else if (tile(k)%vegt == npatch_lake) then !deep lake, from pctlak
                clm(k)%itypwat = istdlak
            do l = 1,nlevssoi
                sand(l,k) = 0._r8
                clay(l,k) = 0._r8

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        end do
    else if (tile(k)%vegt == npatch_wet) then !wetland, from pctwet
        clm(k)%itypwat = istwet
        do l = 1,nlevsoi
            sand(l,k) = 0._r8
            clay(l,k) = 0._r8
        end do
    else if (tile(k)%vegt == npatch_gla) then !glacier, from pctgla
        clm(k)%itypwat = istice
        print*, 'ERR: iniTimeConst -- not supposed to be in glacier block'
    else !soil
        clm(k)%itypwat = istsoil
        do l = 1, nlevsoi
            sand(l,k)=sand1(tile(k)%col,tile(k)%row-tnroffset)
            clay(l,k)=clay1(tile(k)%col,tile(k)%row-tnroffset)
        enddo
    end if
    end if
enddo
! -----
! tag lake points
! -----


do k = 1,numpatch
    if (clm(k)%itypwat==istdlak .or. clm(k)%itypwat==istslak) then
        clm(k)%lakpoi = .true.
    else
        clm(k)%lakpoi = .false.
    end if
end do

! -----
! latitudes and longitudes
! -----


pi = SHR_CONST_PI
do i=1,nc_working
    do j=1,nr_working
        if(gindex(i,j).ne. -1) then
            k = gindex(i,j)
            clm(k)%lat    = grid(tile(k)%index-grid_offset)%lat * pi/180.
            clm(k)%lon    = grid(tile(k)%index-grid_offset)%lon * pi/180.
        endif
    end do
enddo

! -----
! Define layer structure for soil and lakes

```

```
! Vertical profile of snow is initialized in routine iniTimeVar
! -----
if (nlevlak /= nlevsoi) then
    write(6,*)'number of soil levels and number of lake levels must be the same'
    write(6,*)'nlevsoi= ',nlevsoi,' nlevlak= ',nlevlak
    call endrun
endif

dzlak(1) = 1.
dzlak(2) = 2.
dzlak(3) = 3.
dzlak(4) = 4.
dzlak(5) = 5.
dzlak(6) = 7.
dzlak(7) = 7.
dzlak(8) = 7.
dzlak(9) = 7.
dzlak(10)= 7.

zlak(1) = 0.5
zlak(2) = 1.5
zlak(3) = 4.5
zlak(4) = 8.0
zlak(5) = 12.5
zlak(6) = 18.5
zlak(7) = 25.5
zlak(8) = 32.5
zlak(9) = 39.5
zlak(10)= 46.5

do j = 1, nlevsoi
    zsoi(j) = scalez*(exp(0.5*(j-0.5))-1.)      !node depths
enddo

dzsoi(1) = 0.5*(zsoi(1)+zsoi(2))              !thickness b/n two interfaces
do j = 2,nlevsoi-1
    dzsoi(j)= 0.5*(zsoi(j+1)-zsoi(j-1))
enddo
dzsoi(nlevsoi) = zsoi(nlevsoi)-zsoi(nlevsoi-1)

zisoi(0) = 0.
do j = 1, nlevsoi-1
    zisoi(j) = 0.5*(zsoi(j)+zsoi(j+1))          !interface depths
enddo
zisoi(nlevsoi) = zsoi(nlevsoi) + 0.5*dzsoi(nlevsoi)

do k = 1,numpatch
```

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if (clm(k)%itypwat == istdlak) then      !assume all lakes are deep lakes
  clm(k)%z(1:nlevlak) = zlak(1:nlevlak)
  clm(k)%dz(1:nlevlak) = dzlak(1:nlevlak)
else if (clm(k)%itypwat == istslak) then   !shallow lake (not used)
  clm(k)%dz(1:nlevlak) = NaN
  clm(k)%z(1:nlevlak) = NaN
else                                     !soil, ice, wetland
  clm(k)%z(1:nlevsoi) = zsoi(1:nlevsoi)
  clm(k)%dz(1:nlevsoi) = dzsoi(1:nlevsoi)
  clm(k)%zi(0:nlevsoi) = zisoi(0:nlevsoi)
endif
end do

! -----
! Initialize root fraction (computing from surface, d is depth in meter):
! Y = 1 -1/2 (exp(-ad)+exp(-bd) under the constraint that
! Y(d =0.1m) = 1-beta^(10 cm) and Y(d=d_obs)=0.99 with beta & d_obs
! given in Zeng et al. (1998).
! -----
! do k = begpatch, endpatch
do k = 1,numpatch
  if (.not. clm(k)%lakpoi) then
    ivt = clm(k)%itypveg
    do j = 1, nlevsoi-1
      clm(k)%rootfr(j) = .5*( exp(-roota_par(ivt)*clm(k)%zi(j-1))  &
                                + exp(-rootb_par(ivt)*clm(k)%zi(j-1))  &
                                - exp(-roota_par(ivt)*clm(k)%zi(j ))  &
                                - exp(-rootb_par(ivt)*clm(k)%zi(j )) )
    end do
    clm(k)%rootfr(nlevsoi) = .5*( exp(-roota_par(ivt)*clm(k)%zi(nlevsoi-1))  &
                                    + exp(-rootb_par(ivt)*clm(k)%zi(nlevsoi-1)) )

  else
    clm(k)%rootfr(1:nlevsoi) = spval
  end if
end do

! -----
! Initialize soil thermal and hydraulic properties
! -----
do k = 1,numpatch
  if (clm(k)%itypwat == istsoil) then          !soil
    do j = 1, nlevsoi
      clm(k)%bsw(j)     = 2.91 + 0.159*clay(j,k)*100.0
      clm(k)%watsat(j) = 0.489 - 0.00126*sand(j,k)*100.0
      xksat              = 0.0070556 *( 10.**(-0.884+0.0153*sand(j,k)*100.0) ) ! mm/s
      clm(k)%hksat(j)   = xksat * exp(-clm(k)%zi(j)/hkdepth)
      clm(k)%sucsat(j)  = 10. * ( 10.**((1.88-0.0131*sand(j,k)*100.0) )

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        tkm          = (8.80*sand(j,k)*100.0+2.92*clay(j,k)*100.0)/(sand(j,k)*100.0+clay(j,k)*100.0)
        bd           = (1.-clm(k)%watsat(j))*2.7e3
        clm(k)%tkmg(j) = tkm ** (1.- clm(k)%watsat(j))
        clm(k)%tksatu(j) = clm(k)%tkmg(j)*0.57**clm(k)%watsat(j)
        clm(k)%tkdry(j) = (0.135*bd + 64.7) / (2.7e3 - 0.947*bd)
        clm(k)%csol(j) = (2.128*sand(j,k)*100.0+2.385*clay(j,k)*100.0)/ (sand(j,k)*100.0+clay(j,k)*100.0)
    end do
else                                         !ice, lakes, wetlands
do j = 1, nlevsoi
    clm(k)%bsw(j)      = spval
    clm(k)%watsat(j)   = spval
    clm(k)%hksat(j)    = spval
    clm(k)%sucsat(j)   = spval
    clm(k)%tkmg(j)     = spval
    clm(k)%tksatu(j)   = spval
    clm(k)%tkdry(j)    = spval
    clm(k)%csol(j)     = spval
end do
end if
end do

! -----
! Initialize clm derived type components from pft_varcon to avoid
! indirect addressing and be compatible with offline CLM code
! -----

! do k = begpatch, endpatch
do k = 1,numpatch
    ivt = clm(k)%itypveg
    clm(k)%z0mr      = z0mr(ivt)
    clm(k)%displar   = displar(ivt)
    clm(k)%dleaf     = dleaf(ivt)
    clm(k)%xl        = xl(ivt)
    do ib = 1,numrad
        clm(k)%rhol(ib) = rhol(ivt,ib)
        clm(k)%rhos(ib) = rhos(ivt,ib)
        clm(k)%taul(ib) = taul(ivt,ib)
        clm(k)%taus(ib) = taus(ivt,ib)
    end do
    clm(k)%qe25      = qe25(ivt)      ! quantum efficiency at 25c (umol co2 / umol photon)
    clm(k)%vcmx25   = vcmx25(ivt)    ! maximum rate of carboxylation at 25c (umol co2/m**2/s)
    clm(k)%mp        = mp(ivt)       ! slope for conductance-to-photosynthesis relationship
    clm(k)%c3psn    = c3psn(ivt)     ! photosynthetic pathway: 0. = c4, 1. = c3
end do

!Initialize other misc derived type components - note that for a
!restart run, dtime is set in routine restrd()

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```
if (nsrest == 0) then
!    do k = begpatch, endpatch
    if ( masterproc ) then
        tmp_dtime = get_step_size()
    endif
#ifndef ( defined OPENDAP )
    call MPI_BCAST(tmp_dtime,1,MPI_REAL,0,MPI_COMM_WORLD,ierr)
#endif
    do k = 1,numpatch
        !clm(k)%dtime = get_step_size()
        clm(k)%dtime = tmp_dtime
    end do
endif

print*, "DBG: iniTimeConst -- dtime", clm(1)%dtime,' (',iam,')'

if (masterproc) then
    write(6,*)
    write(6,30)
    do j = 1,nlevlak
        write(6,40)zlak(j),dzlak(j)
    end do
    write(6,*)
    write(6,35)
    do j = 1,nlevsoi
        write(6,45)zsoi(j),dzsoi(j),zisoi(j)
    end do
    write(6,50)
    write(6,*)
endif

30 format(' ',' lake levels ',' lake thickness(m)')
35 format(' ',' soil levels ',' soil thickness(m)', ' soil interfaces(m)')
40 format(' ',2(f7.3,8x))
45 format(' ',3(f7.3,8x))
50 format(' ','Note: top level soil interface is set to 0')

return
```